

Listing of the Claims:

The following is a complete listing of all the claims in the application, with an indication of the status of each:

Claims 1-14. Canceled

1 Claim 15 (Original) A magneto-resistance effect element comprising:
2 a lower conductive layer;
3 a fixed layer provided on the lower conductive layer and having a
4 pinned orientation of magnetization;
5 a first non-magnetic layer provided on the fixed layer;
6 a free layer provided on the first non-magnetic layer and having an
7 orientation of magnetization varied by a magnetic field applied thereto;
8 a first magnetic layer provided on the free layer and magnetically
9 coupled to the free layer;
10 a second magnetic layer provided on the first magnetic layer and
11 magnetically coupled to the first magnetic layer; and
12 a vertical bias layer for applying a magnetic field to said first and
13 second magnetic layers, and a sense current for detecting a change in
14 electrical resistance of said first non-magnetic layer flows substantially in
15 perpendicular relation to said first non-magnetic layer.

1 Claim16 (Original). The magneto-resistance effect element according to
2 claim 15, wherein said first magnetic layer is equal to or greater than said
3 free layer in length in the direction of the magnetic field applied by said
4 vertical bias layer.

1 Claim 17 (Original). The magneto-resistance effect element according to
2 claim 15, wherein said second magnetic layer is equal to or greater than

3 said free layer in length in the direction of the magnetic field applied by
4 said vertical bias layer.

1 Claim 18 (Original). The magneto-resistance effect element according to
2 claim 15, further comprising a fixing layer, disposed between said lower
3 conductive layer and said fixed layer, for pinning the orientation of
4 magnetization of said fixed layer.

1 Claim 19 (Original). The magneto-resistance effect element according to
2 claim 15, further comprising a second non-magnetic layer between said
3 free layer and said first magnetic layer.

1 Claim 20 (Original). The magneto-resistance effect element according to
2 claim 15, further comprising a third non-magnetic layer between said first
3 magnetic layer and said second magnetic layer.

1 Claim 21 (Original). The magneto-resistance effect element according to
2 claim 15, wherein said free layer is magnetically coupled to said first
3 magnetic layer by anti-ferromagnetic coupling or ferromagnetic coupling.

1 Claim 22 (Original). The magneto-resistance effect element according to
2 claim 15, wherein said first magnetic layer is magnetically coupled to said
3 second magnetic layer by anti-ferromagnetic coupling or ferromagnetic
4 coupling.

1 Claim 23 (Original). The magneto-resistance effect element according to
2 claim 15, wherein the product of saturation magnetization and film
3 thickness of said first magnetic layer is substantially equal to the product
4 of saturation magnetization and film thickness of said second magnetic

5 layer.

1 Claim 24 (Original). The magneto-resistance effect element according to
2 claim 20, wherein a three-layered film made up of said first magnetic layer,
3 said third non-magnetic layer, and said second magnetic layer is a layered
4 antiferromagnetic body.

1 Claim 25 (Withdrawn). The magneto-resistance effect element according
2 to claim 15, wherein at least part of said first magnetic layer is in direct
3 contact with said vertical bias layer.

1 Claim 26 (Original). The magneto-resistance effect element according to
2 claim 15, wherein at least part of said second magnetic layer is in direct
3 contact with said vertical bias layer.

1 Claim 27 (Withdrawn). A magneto-resistance effect element comprising:
2 a lower conductive layer;
3 a fixed layer provided on the lower conductive layer and having a
4 pinned orientation of magnetization;
5 a non-magnetic layer provided on the fixed layer;
6 a free layer provided on the non-magnetic layer and having an
7 orientation of magnetization varied by a magnetic field applied thereto;
8 a magnetic layer provided on the free layer; and
9 a vertical bias layer, provided on the magnetic layer, for applying a
10 magnetic field to said magnetic layer, and a sense current for detecting a
11 change in electrical resistance of said non-magnetic layer flows
12 substantially in perpendicular relation to said non-magnetic layer.

1 Claim 28 (Withdrawn). The magneto-resistance effect element according
2 to claim 27, further comprising a second magnetic layer between said
3 magnetic layer and said vertical bias layer.

1 Claim 29 (Withdrawn). A magneto-resistance effect element comprising:
2 a lower conductive layer;
3 a first fixed layer provided on the lower conductive layer and
4 having a pinned orientation of magnetization;
5 a first non-magnetic layer provided on the first fixed layer;
6 a first free layer provided on the first non-magnetic layer and
7 having an orientation of magnetization varied by a magnetic field applied
8 thereto;
9 a magnetic layer provided on the first free layer and magnetically
10 coupled to the first free layer;
11 a second free layer provided on the magnetic layer and
12 magnetically coupled to the magnetic layer;
13 a second non-magnetic layer provided on the second free layer;
14 a second fixed layer provided on the second non-magnetic layer
15 and having a pinned orientation of magnetization; and
16 a vertical bias layer for applying a magnetic field to said magnetic
17 layer, and a sense current for detecting a change in electrical resistance of
18 said first and second non-magnetic layers flows substantially in
19 perpendicular relation to said first and second non-magnetic layers.

1 Claim 30 (Withdrawn). The magneto-resistance effect element according
2 to claim 29, wherein said magnetic layer is equal to or greater than said
3 first and second free layers in length in the direction of the magnetic field
4 applied by said vertical bias layer.

1 Claim 31 (Withdrawn). The magneto-resistance effect element according
2 to claim 29, further comprising a first fixing layer, disposed below said
3 first fixed layer, for pinning the orientation of magnetization of said first
4 fixed layer.

1 Claim 32 (Withdrawn). The magneto-resistance effect element according
2 to claim 29, further comprising a second fixing layer, disposed above said
3 second fixed layer, for pinning the orientation of magnetization of said
4 second fixed layer.

1 Claim 33 (Withdrawn). The magneto-resistance effect element according
2 to claim 29, wherein said first free layer is magnetically coupled to said
3 magnetic layer by anti-ferromagnetic coupling or ferromagnetic coupling.

1 Claim 34 (Withdrawn). The magneto-resistance effect element according
2 to claim 29, wherein said magnetic layer is magnetically coupled to said
3 second free layer by anti-ferromagnetic coupling or ferromagnetic
4 coupling.

1 Claim 35 (Withdrawn). The magneto-resistance effect element according
2 to claim 29, wherein at least part of said magnetic layer is in direct contact
3 with said vertical bias layer.

4 Claim 36 (Withdrawn). A magneto-resistance effect element comprising:
5 a lower conductive layer;
6 a first magnetic layer provided on the lower electrically conductive;
7 a second magnetic layer provided on the first magnetic layer and
8 magnetically coupled to the first magnetic layer;
9 a free layer provided on the second magnetic layer, magnetically

10 coupled to the second magnetic layer, and having an orientation of
11 magnetization varied by a magnetic field applied thereto;
12 a first non-magnetic layer provided on the free layer ;
13 a fixed layer provided on the first non-magnetic layer and having a
14 pinned orientation of magnetization; and
15 a vertical bias layer for applying a magnetic field to said first
16 magnetic layer, and a sense current for detecting a change in electrical
17 resistance of said first non-magnetic layer flows substantially in
18 perpendicular relation to said first non-magnetic layer.

1 Claim 37 (Withdrawn). The magneto-resistance effect element according
2 to claim 36, wherein said first magnetic layer is equal to or greater than
3 said free layer in length in the direction of the magnetic field applied by
4 said vertical bias layer.

1 Claim 38 (Withdrawn). The magneto-resistance effect element according
2 to claim 36, wherein said second magnetic layer is equal to or greater than
3 said free layer in length in the direction of the magnetic field applied by
4 said vertical bias layer.

1 Claim 39 (Withdrawn). The magneto-resistance effect element according
2 to claim 36, further comprising a fixing layer, disposed on said fixed layer,
3 for pinning the orientation of magnetization of said fixed layer.

1 Claim 40 (Withdrawn). The magneto-resistance effect element according
2 to claim 36, further comprising a second non-magnetic layer between said
3 first magnetic layer and said second magnetic layer.

1 Claim 41 (Withdrawn). The magneto-resistance effect element according

2 to claim 36, further comprising a third non-magnetic layer between said
3 second magnetic layer and said free layer.

1 Claim 42 (Withdrawn). The magneto-resistance effect element according
2 to claim 36, wherein said free layer is magnetically coupled to said second
3 magnetic layer by anti-ferromagnetic coupling or ferromagnetic coupling.

1 Claim 43 (Withdrawn). The magneto-resistance effect element according
2 to claim 36, wherein said first magnetic layer is magnetically coupled to
3 said second magnetic layer by anti-ferromagnetic coupling or
4 ferromagnetic coupling.

1 Claim 44 (Withdrawn). The magneto-resistance effect element according
2 to claim 36, wherein the product of saturation magnetization and film
3 thickness of said first magnetic layer is substantially equal to the product
4 of saturation magnetization and film thickness of said second magnetic
5 layer.

1 Claim 45 (Withdrawn). The magneto-resistance effect element according
2 to claim 36, wherein a three-layered film made up of said first magnetic
3 layer, said second non-magnetic layer, and said second magnetic layer is a
4 layered antiferromagnetic body.

1 Claim 46 (Withdrawn). The magneto-resistance effect element according
2 to claim 36, wherein at least part of said first magnetic layer is in direct
3 contact with said vertical bias layer.

1 Claim 47 (Withdrawn). The magneto-resistance effect element according
2 to claim 36, wherein at least part of said second magnetic layer is in direct
3 contact with said vertical bias layer.

1 Claim 48 (withdrawn). A magneto-resistance effect element comprising:
2 a lower conductive layer;
3 a vertical bias layer provided on the lower conductive layer;
4 a first magnetic layer provided on the vertical bias layer;
5 a second magnetic layer provided on the first magnetic layer and
6 magnetically coupled to the first magnetic layer;
7 a free layer provided on the second magnetic layer, magnetically
8 coupled to the second magnetic layer, and having an orientation of
9 magnetization varied by a magnetic field applied thereto;
10 a first non-magnetic layer provided on the free layer; and
11 a fixed layer provided on the first non-magnetic layer and having a
12 pinned orientation of magnetization, and a sense current for detecting a
13 change in electrical resistance of said first non-magnetic layer flows
14 substantially in perpendicular relation to said first non-magnetic layer.

1 Claim 49 (Withdrawn). The magneto-resistance effect element according
2 to claim 48, wherein said first magnetic layer is equal to or greater than
3 said free layer in length in the direction of the magnetic field applied by
4 said vertical bias layer.

1 Claim 50 (Withdrawn). The magneto-resistance effect element according
2 to claim 48, wherein said second magnetic layer is equal to or greater than
3 said free layer in length in the direction of the magnetic field applied by
4 said vertical bias layer.

1 Claim 51 (Withdrawn). The magneto-resistance effect element according
2 to claim 48, further comprising a second non-magnetic layer between said
3 first magnetic layer and said second magnetic layer.

1 Claim 52 (Withdrawn). The magneto-resistance effect element according
2 to claim 48, further comprising a third non-magnetic layer between said
3 second magnetic layer and said free layer.

1 Claim 53 (Withdrawn). The magneto-resistance effect element according
2 to claim 48, wherein said free layer is magnetically coupled to said second
3 magnetic layer by anti-ferromagnetic coupling or ferromagnetic coupling.

1 Claim 54 (Withdrawn). The magneto-resistance effect element according
2 to claim 48, wherein said first magnetic layer is magnetically coupled to
3 said second magnetic layer by anti-ferromagnetic coupling or
4 ferromagnetic coupling.

1 Claim 55 (Withdrawn). The magneto-resistance effect element according
2 to claim 48, wherein the product of saturation magnetization and film
3 thickness of said first magnetic layer is substantially equal to the product
4 of saturation magnetization and film thickness of said second magnetic
5 layer.

1 Claim 56 (Withdrawn). The magneto-resistance effect element according
2 to claim 48, wherein a three-layered film made up of said first magnetic
3 layer, said second non-magnetic layer, and said second magnetic layer is a
4 layered antiferromagnetic body.

1 Claim 57 (Withdrawn). The magneto-resistance effect element according
2 to claim 48, wherein at least part of said first magnetic layer is in direct
3 contact with said vertical bias layer.

1 Claim 58 (Withdrawn). The magneto-resistance effect element according
2 to claim 48, wherein at least part of said second magnetic layer is in direct
3 contact with said vertical bias layer.

1 Claim 59 (Withdrawn). A magneto-resistance effect head comprising:
2 said magneto-resistance effect element including
3 a lower conductive layer, a free layer provided on the lower conductive
4 layer and having an orientation of magnetization varied by a magnetic field
5 applied thereto, a non-magnetic layer provided on top of the free layer, a
6 fixed layer provided on the non-magnetic layer and having a pinned
7 orientation of magnetization, and a vertical bias layer, provided on said
8 lower conductive layer, for applying a magnetic field to said free layer, and
9 said free layer is greater in length in the direction of a magnetic field
10 applied thereto by said vertical bias layer than said fixed layer, and a sense
11 current for detecting a change in electrical resistance of said non-magnetic
12 layer flows substantially in perpendicular relation to said non-magnetic
13 layer;
14 a lower shield layer serving as a substrate for said magneto-
15 resistance effect element;
16 an upper conductive layer, provided on said magneto-resistance
17 effect element, for inputting a sense current for detecting a change in
18 electrical resistance of said magneto-resistance effect element into said
19 magneto-resistance effect element; and
20 an upper shield layer provided on the upper conductive layer.

1 Claim 60 (Withdrawn). The magneto-resistance effect head according to
2 claim 59, wherein the lower conductive layer of said magneto-resistance
3 effect element is integrated with said lower shield layer.

1 Claim 61 (Withdrawn). The magneto-resistance effect head according to
2 claim 59, wherein said upper conductive layer is integrated with said upper
3 shield layer.

1 Claim 62 (Withdrawn). A magneto-resistance transducer system
2 comprising:
3 said magneto-resistance effect head according to claim 59;
4 an electric current generator circuit for supplying a sense current to
5 said magneto-resistance effect head; and
6 a data read circuit for detecting a change in electrical resistance of
7 said magneto-resistance effect head to determine a magnetic field applied
8 to said magneto-resistance effect head.

1 Claim 63 (Withdrawn). A magnetic storage system comprising:
2 said magneto-resistance transducer system according to claim 62;
3 a magnetic storage medium having a plurality of tracks for
4 allowing said magneto-resistance transducer system to write and read data
5 thereon;
6 a first actuator for moving said magneto-resistance transducer
7 system to where a selected track is located in said magnetic storage
8 medium; and
9 a second actuator for rotatably driving said track.